article of 1884, the Sparrow, as a migrant, has become well known to ornithologists. Its narrow migration path, the center of which in the United States is approximately down the 96th meridian, has been worked out; the wide extent of territory covered by stragglers has been fully reported;[1] the food habits of the bird while on migration have been thoroughly investigated and the results published;[2] the nest has been seen once,[3] and young just out of the nest have been collected,[4] and the general region of the breeding ground itself is known to be where barren tundra meets the edge of the timber between Hudson Bay and Great Bear Lake. But the eggs yet remain to be discovered.

NOTES ON THE STRUCTURE OF THE PALATE IN THE ICTERIDÆ.

BY ALEXANDER WETMORE.

THE curious keel-like, angular projection found on the palate in the North American Grackles of the genus *Quiscalus*, recognized as one of the prominent characters distinguishing that group of Blackbirds, is a structure that can hardly fail to attract attention when the mouth is examined in freshly killed specimens, or in birds preserved in spirits. Recently, certain observations made in the field on these birds, which will be recounted later, recalled this structure to mind and the writer was led to make a somewhat detailed study of the palatal keel in the Grackles, and finally to examine the appearance of the palate in other members of the family *Icteridæ*. In these studies, carried on in the United States National

[1] The Status of the Harris's Sparrow in Wisconsin and Neighboring States. By Alvin R. Cahn. Bull. Wis. Nat. Hist. Soc., Vol. XIII, No. 2, pp. 102–108. Also in numerous lists and field notes published in 'The Auk,' 'Wilson Bull.' and the other bird journals.

[2] The Relation of Sparrows to Agriculture. By Sylvester A. Judd. Bull. Biol. Surv. No. 15, 1901.

[3] Bird Records from Great Slave Lake Region. By E. T. Seton. The Auk, 1908, p. 72.

[4] Biological Investigation of Hudson Bay Region. By E. A. Preble. N. A. Fauna No. 22. Washington, 1901.

Museum, there have been available suitable specimens representing all of the leading genera with the exception of *Clypeicterus, Ocyalus, Lampropsar* and *Macragelæus.* In all, one hundred and thirteen species belonging to thirty-one genera have been examined.

Study of skins of the genus *Quiscalus* shows that the palatal keel is developed as a compressed projection from the roof of the mouth, slightly behind the center of the commissure (Fig. 1). Viewed

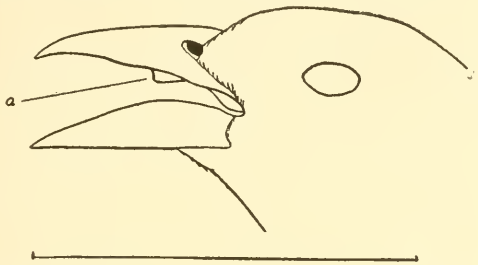

Fig. 1. Head of *Quiscalus quiscula aeneus.* *a* Palatal keel (about natural size.)

from the side it is truncated in front, forming an angular projection that has a tendency to become toothed at the tip. Posteriorly it lowers to merge finally into the level of the palate. The anterior margin is sharp, and the posterior portion is thicker and stronger. The entire ridge is developed as a fold in the horny sheathing of the palate, and the surface of the premaxilla underneath is smooth and flat with no indication of a bony ridge to support the keel.

From the examination of museum skins it appears that the palatal ridge begins to develop in juvenile birds a short time before they leave the nest, at a stage when the body is well covered with feathers, and the incoming tail feathers have attained a length of 20 to 25 millimeters. In such birds the keel appears as a very slightly raised ridge that forms a distinct line on the palate. The bill at this time has reached about three-fourths of the length attained when the bird is adult, so that the beginning of this ridge appears to be located far forward, though it occupies the same position in relation to the external nasal opening that the fully developed keel does in the adult. In the dried skins the ridge is somewhat indistinct, but it is possible that it may be more readily apparent in living or recently killed specimens.

In birds that are almost fully feathered and that are about ready to leave the nest the bill has become stronger, the raised palatal line is heavier, and has a rounded anterior end that forms a marked projection and then continues to merge with the palate in front. In older specimens, able to fly but with the rectrices only 95 to 105 mm. long, the palatal ridge was better marked, being broad and strong basally and more slender toward the point. In a few of the specimens of this stage examined the cutting angle seemed well developed, but in others it was less strongly indicated. In birds that were fully grown but still in juvenal plumage the ridge was well developed but not so prominent as in adults. In some the basal portion was broad and rounded, verging toward the formation of palate found in the genus *Megaquiscalus*. In others the anterior cutting angle was more prominent but the entire ridge had only attained from one-half to three-fourths of its full height.

No one apparently has raised the question of the possible function of this keel, developed as described above, so that it seems proper to record here certain field observations made by the writer that indicate the use of this structure. As might be expected it serves in securing and preparing certain parts of the food. In December 1917, near Stuttgart in eastern Arkansas, during a time when the ground was covered by a light fall of snow, flocks of Bronzed Grackles were found feeding among small groves of a pin oak (*Quercus pagodaefolia*). The ground under these trees was nearly bare and the birds were working about searching for the small acorns that had fallen and were partly concealed under leaves and low plant growth beneath the oaks. The Grackles were tame and with a pair of binoculars it was an easy matter to watch them at close range. The acorns were picked up, held in the bill and pressed firmly against the keel on the palate, then released, turned slightly by means of mandibles and tongue, and then again gripped strongly. In this way the acorn was rotated until a line had been impressed entirely around the shell. With a little further manipulation the shell dropped off in two halves and the kernel was swallowed entire without further preparation, though frequently it was gulped down only after some effort. After watching one feeding flock for some time I clapped my hands sharply to startle them and then examined the ground where they had been at work.

Scattered among the leaves were many acorn shells, most of which had been cut in two in a line transverse to the longitudinal axis. Some had fairly smooth, clean-cut margins, while others were roughened and jagged. In searching through the leaves I picked up one acorn still intact that had been dropped by one of the birds, perhaps when the flock was frightened up, in which a line had been impressed entirely around the center. In this the impressions of the palatal keel were distinctly visible.

When attention was once attracted to this manner of feeding other incidents were noted in which the palatal keel was brought in play. On one occasion on the streets of Washington a Purple Grackle was observed attempting to split open a kernel of corn dropped from some passing dray. The bird held this grain in the slight notch near the center of the bill and pressed it against the angular keel. The grain proved refractory, as it snapped out several times, dropping 8 or 10 inches away, to be seized and again compressed. Watching until it had been dropped I frightened the bird and secured the kernel of corn. On one side four grooves impressed in the hard outer surface were visible showing where, and with what force, the sharp keel had been applied.

Apparently the palatal ridge develops with the gradual growth of the bill, and becomes fully functional shortly after the immature bird is left by its parents to its own resources in securing food. It seems to be fully grown in all by the middle of September. In many adult specimens the ridge shows signs of heavy wear from the nearly constant use to which it is put. In some the cutting angle was well rounded in front from constant abrasion, while in others the anterior margin had become irregular and broken. In one specimen the thin lower margin of the compressed keel was entirely worn away, leaving a low rounded projection in which the two sides of the fold by which the keel had been formed were clearly visible, with a line of separation between them. It was interesting to note that the palatal ridge was usually well worn in old adults, taken in late fall or early spring, belonging to the northern races (*Quiscalus q. quiscula* and *Q. q. æneas*) while little or no wear was apparent in similar specimens of the southern form (*Q. q. aglæus*) from South Carolina and Florida. The data available from the examination of a small number of stomachs of this

form from Florida show a preponderance of insects and fruits with very little mast or grain, a fact of interest, but one that is not fully substantiated as the material available is small.

Among near relatives of *Quiscalus quiscula* a slightly developed palatal ridge was encountered in *Megaquiscalus macrourus,* where the projection was broad and well rounded posteriorly, and narrow in front with the lower margin acute, forming a sharp keel. In some specimens seen this keel was slowly reduced until it merged smoothly with the palatal surface in front. In others the anterior margin was obtusely declivous. The obtuse anterior cutting angle projected below the margins of the tomia for nearly a millimeter in a few individuals, and in these occasional specimens the resemblance was striking to those bills of *Quiscalus* in which the ridge was most poorly developed. Juvenile specimens of *Megaquiscalus m. macrourus* from Fort Clark, Texas, that had been collected just after they had left the nest, had the palatal ridge already well indicated though only about one-half developed. In the slender-billed forms known as *Megaquiscalus tenuirostris* and *M. nicaraguensis* the palatal keel was much as in *M. major* though slighter and less pronounced.

In Blackbirds belonging to the West Indian group known as *Hoploquiscalus* a raised line was also more or less developed. In general the growth was similar to that in *Megaquiscalus* as the posterior portion was broad and rounded, while anteriorly the ridge was narrowed and the lower margin became acute. There is some variation in the size of this anterior portion; in a few the crest is obtusely declivous in front, approaching the condition found in *Quiscalus,* but never with the keel produced so that it projects below the plane subtended by the cutting edges of the tomia.

The discovery of a peculiar knoblike process on the palate of the mexican orioles belonging to the species *Icterus gularis* was one of the really surprising discoveries made during a more or less cursory examination of the palate in various species and genera of *Icteridæ* picked out at random, and it was the finding of this structure in an Oriole that led to a detailed examination of all of the material available. In *Icterus gularis* the palatal ridge is from 1.2 to 1.5 millimeters high at its anterior end (Fig. 2). The entire structure is broad and somewhat flattened. The ventral surface is slightly

rounded, the sides slightly sloping, the sides and lower surface joining at a sharp angle. In front the ridge is abruptly truncated at its ventral margin where there is sometimes a slight tooth or projec-

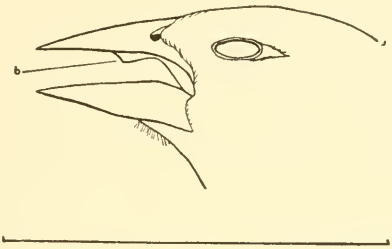

Fig. 2. Head of *Icterus gularis yucatanensis*. *b*. Palatal knob (about natural size.)

tion. Below this point the anterior surface slopes abruptly, and then passes over into the roof of the palate. The ridge is about two millimeters broad, and there is a slightly indicated raised line on the ventral surface for three-quarters of its length behind. From this description it may be seen that this blunt projection is entirely different from the sharply keeled ridge found in *Quiscalus*.

Examination of other orioles shows that *Icterus gularis* stands alone in respect to this development as there is nothing found in other species that approaches it save for a broad, low, rounded projection, slight but distinct, that is found on the palate in *Icterus xanthornus*. In *Icterus laudabilis* and *I. prosthemelas* there is a very slightly raised median ridge developed on the posterior part of the roof of the mouth. In twenty-eight other species belonging to this genus the palate exhibits no peculiarities worthy of mention. This structure in the bill in *Icterus gularis* is constant in its presence, and serves as a trenchant character distinguishing it from other orioles, or in fact from any other members of the *Icteridæ* that have been available for examination. The differences pointed out above, together with others of lesser importance, seem to be of generic value. It is therefore proposed to recognize for this species the genus name

Andriopsar Cassin.[1]

Type.— *Ps[arocolius] gularis* Wagler, Isis, 1829, p. 754 (type locality, Tehuantepec, Oaxaca).

Diagnosis.— Medium-sized *Icteridæ* with short, heavy bill; a prominent knob-like projection on the posterior median portion of the palate, broad and somewhat flattened in general form, with abrupt sides, truncated in front, sometimes with a tooth or notch at the anterior ventral angle, about 2 millimeters broad and from 1.2 to 1.5 millimeters high in front; depth of culmen at base nearly equal to one-half length of culmen (varying from slightly more to slightly less); tarsus slightly longer than culmen from base; middle toe with claw equal to two-thirds, or slightly more, of length of tarsus.

One species in which three subspecies have been described is at present known to belong in this genus. These will stand as follows:

Andriopsar gularis gularis (Wagler)
Andriopsar gularis tamaulipensis (Ridgway)
Andriopsar gularis yucatanensis (Berlepsch)

At present there is no information on the feeding habits of these orioles available but it seems certain that they will show some striking peculiarity in choice of food or in manner of securing and handling it when the life history of the species is better known.

In conclusion I desire to give a brief summary of the condition of the palate in other *Icteridæ* where comment is necessary. In *Euphagus carolinus* and *E. cyanocephalus* there is a slight elongate ridge of low elevation, rounded posteriorly more acute in front, and not projecting as far as the level of the tomia. This raised line is slightly more pronounced in *E. carolinus* than in *E. cyanocephalus* in spite of the fact that the latter has a heavier, stronger bill. The species known as *Ptiloxena atroviolacea* has an elongate, narrow, slightly elevated ridge on the posterior portion of the palate, rounded behind and more or less acute in front, but with too low an elevation to be considered a highly specialized structure. Sumichrast's Blackbird (*Dives dives*) has a palatal structure somewhat resembling that of the genus *Hologuiscalus* save that the entire ridge is shorter.

[1] Proc. Acad. Nat. Sci. Philadelphia, Vol. XIX, 1867, p. 49.

With regard to others, *Tangavius æneus* has a slight ridge, that becomes stronger behind, extending for two-thirds the length of the palate. A similar ridge in *Molothrus badius* is less developed at its anterior end than in the preceding genus. In *Molothrus fringillarius* (one specimen only examined) this ridge is still less in development. In *Molothrus ater*, the cutting edges of the tomia do not extend below the level of the palate, and there is a rounded swelling behind the center; in *Molothrus atronitens* only a very slight ridge is present, and finally in *M. rufo-axillaris* there is no peculiarity worthy of mention. *Nesopsar nigerrimus* shows a well marked rounded ridge on the posterior part of the palate that merges into the anterior surface without becoming produced as an angle. *Xanthopsar imthurmi* shows a slightly developed posterior ridge, while in *Agelaius phœniceus* (including *gubernator*) there is a very faint swelling at the posterior end of the palate, that becomes much more pronounced in *A. tricolor*. *Agelaius thilius* and *A. icterocephalus* show a faintly raised median line, that in the latter species is broadened and rounded posteriorly. *Amblyrhamphus holosericeus* has a long, low, keeled median ridge, and in the three species of *Sturnella* there is an elongate keel, that is rounded behind and acute in front. In *Curæus aterrimus* the palate is on a level with the edge of the tomia, and has a low rounded bulge on its posterior surface. *Trupialis militaris* and *T. falklandicus* have a slight rounded posterior ridge, that is absent in *T. bellicosa* and *T. defillipi*, and finally in *Gymnomystax melanicterus* there is a low, narrow, keeled ridge on the posterior part of the palate, that merges gradually into the surrounding level in front. None of the other species seen present any marked peculiarities.